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ABSTRACT

In designing teaching materials for Open University students' use, authors have been encouraged to incorporate in-text questions to assist students in understanding the materials. These are relatively simple, limited-scope questions relating directly to the preceding material, and are called enabling questions. These are contrasted with the broader self-assessment questions. This study was undertaken to learn whether the in-text questions are serving the authors' purposes of making the material more accessible to students, and whether it is understood how students use this technique. Arguments for and against the use of this device are reported and the literature reviewed. It is concluded that currently available research does not provide a clear and useful picture of students' use and perception of in-text questions, or of the ways student responses correspond to the authors' intent. Some evidence was uncovered that the questions have negligible or negative effects, suggesting urgent need for further research. A list of references is appended. (MSE)

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STUDY METHODS GROUP
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STUDENT LEARNING AND COURSE DESIGN 1: IN-TEXT TEACHING DEVICES IN OPEN UNIVERSITY TEXTS

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ABSTRACT

This paper asks whether, from the evidence available, in-text teaching devices in Open University correspondence texts are fulfilling authors' expectations and improving student learning, and whether we understand how students use them. It is argued that much of the evidence which has been used to justify the use of certain devices lacks relevance and validity and that their inclusion in texts may not foster the form of learning intended. The paper concludes that we know relatively little about how Open University students actually use these devices and that research is needed in the area as a matter of urgency.

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The Study Methods Group is formally recognised as a Research Group in the Institute of Educational Technology. The overall aim of the group's work is to understand how students approach studying with the University's distance learning material and why they adopt particular approaches. This understanding is contributing to the development of a sounder theoretical basis for improving student learning.

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Student Learning and Course Design: I
In-Text Teaching Devices in Open University Texts.

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Student Learning and Course Design: I In-Text Teaching Devices in Open University Texts

Abstract

This paper asks whether, from the evidence available, in-text teaching devices in Open University correspondence texts are fulfilling authors' expectations and improving student learning, and whether we understand how students use them. It is argued that much of the evidence which has been used to justify the use of certain devices lacks relevance and validity and that their inclusion in texts may not foster the form of learning intended. The paper concludes that we know relatively little about how Open University students actually use these devices and that research is needed in the area as a matter of urgency.

1. Background to our current concern

Earlier reports from the Study Methods Group have described how students differ in their orientations to their studying (Taylor, Gibbs & Morgan, 1980) in their understanding of learning (Gibbs, Morgan & Taylor, 1980) in their approach to specific study tasks, (Morgan, Taylor & Gibbs, 1982) and in the quality of their consequent learning outcomes (Taylor, Morgan and & Gibbs, 1981). The crucial relationship between students' approach and what they learn has been discussed (Morgan, Gibbs &Taylor, 1981) and we have illustrated the way students' approach can be partly understood in terms of students' orientation and conception of learning. These reports have described several aspects of student learning as it has been experienced by learners, and have provided categories of description with which to make sense of examples of learning. What these reports, and the research behind them, have not done is to describe how the quality of student learning in the Open University (OU) is influenced by specific aspects of course design. We see this as an important step in understanding student learning. Having established the validity of categories of orientation, conception of learning, and approach, in the context of Open University study, we are now in a position to try and make sense of students' experience of specific aspects of their courses. One key aspect in course design is the role of in-text questions. Previous qualitative research

has highlighted issues in this area. What is more, course unit authors spend considerable time devising them and discussing their likely contribution to OU texts, often on the flimsiest of evidence. However, before further discussion we would like to try and resolve one of the problems surrounding the whole area - one of terminology.

2. Terminology

The terms used to describe the questions, activities, exercises, problems etc. that appear in correspondence texts, and which are not used for the grading purpose of assesment, vary from course to course, faculty to faculty. Originally, the terminology was linked to objectives (Macdonald-Ross, 1973).

> "If a unit has well-specified objectives they can be divided into terminal objectives which describe end-of-unit performance and enabling objectives which describe behaviours leading up to the terminal performance. Therefore, questions may be called enabling questions or terminal questions as they may assist the student attain the corresponding objectives. This distinction lay at the basis of Self-Assessment Questions (SAQs) and In-Text Questions (ITQs). Originally, an SAQ measured end-of-unit performance and was meant to be equivalent to an assignment question of the CMA type. The message to the student was, if you can do the SAQs then you are ready to do the assignmnts. ITQs were more limited in scope, usually of a simpler form and directly related to preceding teaching material. They served an "enabling" function. A great deal of confusion has arisen recently which has largely vitiated the usefulness of this distinction. This confusion has arisen from authors and editors not understanding the origin or meaning of the terms."

However, as Macdonald-Ross notes, different groups within the OU have used the terms to denote different things. In some areas of the University "In-Text Questions" (ITQs) have become associated with those questions that are forward looking, those that demand the use of existing knowledge to identify a course of action, possible implications, applications etc. In contrast "Self Assessment Questions" (SAQs) have become associated with those questions that look back; those that revise, summarise, consolidate - ensuring the student is "on course" before progressing further.

In other areas, rhetorical questions designed to encourage thought or reflection, and for which no model answers or comments are given, are termed ITQs whilst the label SAQ is given to any question that appears in the text; whether it looks forward or back. It gets even more confusing when the terms Activity and Exercise are used to denote the same sort of thing! In this paper we have used the general term 'in-text question' throughout to signify the whole range of devices available; the terms ITQ and SAQ are retained only when they appear in direct quotes from other sources.

3. Author's expectations

Persuasive arguments, designed to encourage authors to integrate questions into Open University teaching texts, have been repeatedly employed in course teams. Many of us have endorsed the idea of a "tutorial in print" (Rowntree, 1973) and numerous "Notes to Course Unit Authors" have perpetuated the idea. The following extract (Lockwood, 1978) is typical:

> "You can simulate this tutorial process by thinking of the hours that students will spend working on your material as time spent in your company. What would you expect them to do during that time? It is unlikely that you would expect them simply to read your material from start to finish without reacting to it in some way or producing anything themselves. You may, for example, ask them to recall items of information, to define concepts, draw together arguments, justify particular statements, consult other courses, interpret data, compare different interpretations of the same data, work out examples, discuss things together and so on. In short, you would expect the exercise of certain study skills by which students construct their own picture of the subject and learn to integrate what you have just taught them with what they have learnt before".

This advice is repeatedly translated into statements indicating the intended function of in-text questions to students and typically appears in the Introduction and Guide to a course; the extract below from D101 Understanding Society (Open University, 1978) is typical:

> "Study activities. With each unit in the correspondence text you will find groups of Self-assessment Questions (SAQs). These may be short exercises or multiple-choice questions relating to what you have just read or worked on. They may refer to the set book or a Reader article

> as well as to the correspondence text itself, but in all cases their function is the same to guide you in your independent learning and to help you decide whether you have grasped the main points in one section before going on to the next. Try to spend as much time as you can on the questions and jot down your answers - they will not be marked, and no one else need see them. When you have finished a group of questions compare your answers with those given at the end of the relevant unit; in some cases yours will be either right or wrong, but in others where choice or opinion is asked for, the author will have given an example of the kind of answer that shows understanding. When you are satisfied with your answers to SAQs go on to the next section of the unit text. In addition to SAQs you will also find in several units activities or questions for discussion. These are much more open-ended than SAQs, and could serve as discussion topics in tutorials or for students amongst themselves."

Similar phrases, in the Introduction and Guide to other Foundation Courses, claim that in-text questions:

> "...alert you to the really important issues involved, and help you to sort them out for yourselves."
> A101, An Arts Foundation Course (Open University, 1978a).

> ".....to help you judge how well you are achieving the Objectives of the Unit".
> S101, Science: A Foundation Course (Open University, 1979).

> "....will be aimed solely at the objectives you are expected to achieve."
> T101, Living with Technology, A Foundation Course. (Open University, 1980).

However, there is a distinct lack of evidence to indicate whether these claims actually coincide with students' perception of the main parts, important issues and key objectives.

The precise expectation of student behaviour in response to in-text questions, are stipulated in the texts of OU courses. The limited evidence available (Lockwood, 1982) suggests that the vast majority of students simply do not respond to them along the lines suggested by authors.

In-text teaching devices - do they work?

There is an enormous literature on 'mathemagenic' devices: on the use of questions inserted into texts in order to improve learning outcomes. The conclusion which is generally drawn from the literature is that such devices improve learning outcomes. The initial study (Rothkopf, 1965) and much subsequent research has produced a fair concensus concerning the effects of inserted questions, summarised below:

> "1. Inserted questions which appear before the material to which they relate (pre-questions) have a substantial specific facilitative effect but no general facilitative effect.
>
> 2. Inserted questions which appear after the material to which they relate (post-question) have a substantial specific facilitative effect as well as a small general faciliative effect on post-test scores."
>
> (Faw and Waller, 1976)

That is , both pre-questions and post questions facilitate intentional learning, but only post questions facilitate incidental learning.

However, the validity of many of these experimental findings and their relevance to an OU context must be in doubt.

An immediate question we would like to raise is whether experimental paradigms in which the value of in-text questions has been assessed have ecological validity: that is, whether students in these experiments study in the same way that they do in natural settings. In a research study (Saljo 1979) it was reported that students described tackling experimental learning tasks in ways they felt to be atypical, even when there was no experimental control over their strategy:

> "even subjects who report themselves as having once and for all decided never to use a memorizing strategy when learning, claim that it is very easy to fall back into this behaviour in an experimental condition. It seemed that there was a strong inclination on the part of students to "do well" in experimental situations, and this, together with a lack of information about what would be considered a "good" learning outcome, tended to lead to students adopting a memorizing approach"

In a review of research (Duchastel 1979) one major way in which experimental paradigms do not resemble normal studying was identified. In most studies, students are not permitted to study freely: they cannot review and move forwards and backwards in their texts. Duchastel found that where students are allowed to study freely, (for example to go back through the text after encountering post questions) then incidental learning is not enhanced and may even be depressed;

> "in these studies then, post questions would seem to have shaped a selective learning strategy whereby attention is focussed primarily on question-related content, sometimes to the detriment of other content"

This is a finding we will encounter again in different contexts.

A second, equally important question, concerns the generalisation of findings from experimental situations where the focus has typically been upon very small amount of text, or at the most a few pages of material, often with short answers/sentence completion requiring a low level response rather than a substantial body of material and wide range in questioning strategies and demands. In a review of evidence associated with adjunct questions (Anderson and Biddle, 1975) concern was expressed over such generalisation to real world situations.

> ".....serious application of questioning techniques in the real world of instruction will require knowing why they work and under what conditions."

Rickards and Denner (1978) in a more recent and substantive review of inserted questions, expressed similar concerns.

> ""Perhaps the issue of greatest importance in adjunct questions research concerns the nature of the adjunct question paradigm itself. First of all, within this paradigm, empirical consideration should be given to letting students review the material to answer the post questions.....Such a modification should be tested since it represents a more ecologically valid procedure than that which is currently employed. At this present time, one must be wary of making generalisations from studies employing the adjunct question paradigm to question answering in general."

At this point it is worth considering a criticism of mathemagenic devices from a different perspective - one that a number of theorists are advocating.

> "What is central in the reading process is the reader's uninterrupted contact with the subject matter in the text. A direct result of this is that every form ofinterruption of the contact betwen the reader and the text's subject matter leads to a deterioration of the reader's performance. Such interruptions can be.... of such apparently high content promoting value as, for example, those which occur with the most refined mathemagenic activities. They can.....have the form of direct questions or structuring sentences which have been slipped into the running texts. A common feature of all these different phenomena is that they do not in any way promote any form of contact between the text's subject matter and the reader on the reader's own terms. This means, of course, that the only aid which is adequate for a better understandiing of the text comes from the reader's own frame of reference. Everything that is brought in from outside, e.g. pure technical advice or structuring measures affecting the content with an assumed basis in the author's frame of reference or an actual basis in someone else's frame of reference, puts a stop to the spontaneous and necessary interplay between the reader and the text's subject matter."
>
> (Edfeldt, 1976)

The above reservations are disquieting and are even more so when we are made aware that effective readers do not study in the way subjects in experiments are required to study, that Open University students do not use in-text devices in the way they were designed to be used and that OU students do review - they do more forwards and backwards in their texts (Nathenson,1978). There therefore seems to be a fairly large question mark over the relevance of much of the literature on in-text questions to an Open University context and any where the student is allowed to study without constant supervision. What is more, we detect a growing doubt within the Open University about the value of some of its cherished teaching devices and of some commonly held assumptions about what is helpful to students. The recent paper: "Why can't a Unit be More Like a Book?" (Jeffcoate, 1981) is but one example of this doubt. There appears to be a gulf of credibility between the conclusions from experimental research and the expectations of course unit authors.

4. Influences upon student learning

Authors attempt at control

Despite strong criticism (e.g. Northedge, 1976) there is still a tendency to perceive the task of writing course units as one of carefully controlling the way students learn. The logical structuring of the text and the strategic insertion of in-text devices of various kinds in order to control student learning is regarded by many as an admirable goal. Indeed, to this end, in-text questions are often accompanied by indications of recommended study time, framework or headings for a response etc. However, research into what students do when they tackle OU materials suggests that control may be unattainable: that even if it were desirable it would not be possible to achieve. The one consistent strand running through the few descriptions of students' use of in-text questions is that students vary enormously in what they do when they work through units. (Henderson, 1977, Duchastel and Whitehead, 1980, Nathenson, 1978).

Just to give a flavour of the extent of this variation, we will give some examples from a study (Nathenson 1978) in which the way fourteen students studied a Materials Science Unit and set book was revealed through students written responses to feedback questions interpolated into the text at appropriate points. The unit author had a carefully worked out strategy for students to follow in studying the unit and book. Only two students in the study used some pre-questions in the way intended by the author: to focus thoughts ahead of reading the text. All the other students used a variety of other strategies. The in-text questions were also treated in widely differing ways. About a quarter of students conscientiously wrote answers to all of them. About a quarter did not answer any of them. The multiple choice type of in-text question which could be answered by applying mathematical algorithms were answered far more frequently than those which were open-ended and required more thoughtful written answers. In-text questions were taken less seriously and often read as if they were simply part of the text. On the basis of this data Duchastel and Whitehead (1980) argued:

> ".....that adult and experienced students should use study aids in ways other than those intended by the authors is, we think, more a demonstration of the versatility of inserted questions and of the ingenuity of our students, than it is a statement for or against the value of questions."

We would observe that the fact that students do not use such questions in the way they were intended to be used undermines the credibility of attempts to carefully control the way students work through texts. Furthermore, that students say they do use such questions does not always reveal how - a point we address below.

Quality and distribution of attention.

A distinction has been made between two sorts of variation in students' approaches to learning tasks (Dahlgren, 1975). What he refers to as horizontal variation is concerned with which aspects, of a text for example, are attended to. There can be variation in what, or how much, is learnt from reading a text. At the same time there can be variation in a vertical dimension; concerning the level or quality of attention: whether a surface or deep level of approach is adopted. From observing that students in experimental conditions tended to adopt a surface approach, and from reviewing the literature on devices such as in-text questions, Dahlgren concluded:

> ".....the controlling factors derived from the mathemagenic hypothesis probably do not have the ability to create a qualitatively new pattern of learning activities. Rather, the effects on the learning result are to be found in the horizontal variaton of the level of attention created by the questions. In other words, these lead to an alternative distribution of learning activities in accordance with the distribution dictated by the demands of the situation as it is expressed in the questions." (Dahlgren, 1975)

As suggested by Duchastel, above, it may be that devices such as post-test questions merely focus attention on specific content, at the expense of depth of treatment of the whole.

Experiments (Dahlgren, 1975) which involved the insertion of in-text questions into Samuelson's textbook "Economics" and the analysis of the quality of students' understanding of the key ideas addressed by the in-text questions, failed to show any positive effect of the questions. In fact some questions appeared to result in qualitatively poorer learning outcomes (see Gibbs, Morgan & Taylor, 1982, for further details).

Now it may be that while specific in-text questions, referring to specific subject matter, do not result in improvements in the vertical dimension of students' approaches to texts, some specific instruction to undertake a deep level approach to the task might. A study was conducted (Marton, 1975) in which content neutral questions were inserted into a text after each section (e.g. "can you summarise the content of each sub-section in one or two sentences?") for an experimental group, and in which a control group were allowed to read as whey wished. The nature of the learning outcomes were analysed in two ways, intended to tap variations in horizontal and vertical dimensions of students' approach, respectively: whether students answers to post-questions were considered adequate or inadequate descriptions of the topic, and whether topics were merely mentioned or described. Students who read texts with inserted questions produced only half as many adequate descriptions of the topic compared to the control group, while merely mentioning topics four times as frequently. It seems that the in-text questions, far from inducing deep level processing, merely fixated students on the specific demands on the questions and appeared to lead to a far narrower conception of the learning task than was intended. The approach to study was described as 'technified' (Marton, 1975, Marton and Saljo 1976b) and one which is induced by in-text questions. It was suggested that it may be difficult to improve learning outcomes qualitatively by using such questions, especially for some students.

5. Student use of in-text questions

Provisions of feedback

A very common argument used in the OU in favour of in-text questions is that they provide students with immediate feedback on their learning progress (Gale 1983). As, with our systems-oriented view of learning no-one is likely to object to giving students feedback, this would at first glance seem to be a strong argument. What we would like to query here is whether the feedback provided is necessarily of value in fostering "worthwhile" learning.

We would first like to draw an analogy here with what happens when students revise by simply reading over their notes or units. They tend to get quite a strong feeling of familiarity with the material of: "oh yes, I remember

this". This gives students confidence. However, it is likely to be a false confidence as this sort of superficial level of processing the text has minimal and short lasting consequences for learning outcomes.lasting consequences for learning outcomes.

There is also the danger of an instrumental approach to learning being reinforced - an approach where for each section of material there is an obvious question with an appropriate answer. It could cause students to look for similar questions/answers in subsequent reading with more challenging, high level questions being reduced to recall of authors summaries of argument involved. It is possible that some in-text questions perform these functions for students. We know that students often look up answers or read the answers without first attempting to answer questions for themselves (cf. Duchastel and Whitehead, 1980, Nathenson 1978) and that at the same time students often report finding such questions helpful. They may well give students an immediate impression of being on top of the subject matter, whether they are in fact in command of it or not. But what are the longer term consequences of such questions? If, as been suggested, questions lead to surface level approaches to studying we might expect texts with inserted questions to lead to worse long term learning outcomes, as surface level approaches tend to produce only short-term benefits. There is some evidence that this is exactly what happens.

For example, when questions were inserted with the intention of inducing a surface level approach into sections of a textbook (Marton and Saljo, 1976b) the questions had a predictable effect on students in that they paid close attention to the surface structure of the text: to list points, figures and so on. Many students thought that the demands of these questions coincided closely with their own conception of learning, e.g.

> "I thought they were more or less what you might expect to be asked."

These students were able to recall, on average, 2.75 out of 5 statements the author had made in the text about the relationship between growth and development: quite a reasonable level of performance, and one that must have been reassuring to the students. However only 45 days later average

recall was down to 0.2 statements. Questions which are interpreted by students as demanding a surface approach to the text appear to produce extremely poor long term learning outcomes, while producing good enough immediate outcomes (in terms of ability to recall information) to give inaccurate feedback to students about their learning.

The helpfulness of in-text questions

Evaluation of the relative value of components of the total teaching package available to OU students has often consisted of little more than using 'helpfulness' ratings. In a report of students' rating of questions (Kaye, 1972) they were regarded as 'important' study aids, and one could imagine using helpfulness rating as a research tool - trying to pick out which particular in-text questions students feel helpful.

While there has been considerable debate concerning the construction of helpfulness rating scales and the mathematical juggling of the ratings themselves, there has been less debate concerning what these ratings could possibly indicate, and indeed whether a 'high' helpfulness rating is actually a good thing. We ought to be asking: "helpful to achieve what?" It is clear that OU students are actually trying to achieve different things: that they are oriented towards different aspects of their courses (cf. Taylor, Gibbs and Morgan, 1981). Thus, one student might find a question helpful because it appears to indicate what is to be assessed: what counts as a learning outcome. Another might find it unhelpful because it fails to relate to personal interests. Yet others may mistakenly find it helpful because, they have a conception of learning which results in them seeing memorization as learning, and the dutiful regurgitation of an earlier section of text as an acceptable learning outcome. In the study described above (Nathenson, 1978) it was found that a quarter of students did not answer any in-text questions because, they said, they were exclusively concerned with assessed work. Would such statements resulting in low helpfulness ratings indicate 'bad' in-text questions or not? Nathenson also reported that a quarter of students dutifully answered all questions, in an apparently passive response to everything which was requested of them. Passively working through a text in the order the text is presented may produce poor long term learning outcomes. These students might be expected to find

the in-text questions helpful. But would these high ratings indicate 'questions? With the exception of a little qualitative evidence from Nathenson, Duchastel and Whitehead, we have found little to indicate what helpfulness might actually mean and so we are a long way from understanding what makes them helpful.

6. The need for research

We believe that given the widespread use of various sorts of in-text questions in the OU, the available research evidence does not provide a particulrly clear and useful picture of the context within which students perceive and use in-text questions, nor the ways in which student responses correspond with the author's intent. The doubts we have raised about the validity of traditional justifications of in-text questions, and the either negligible or disturbing effects which we have observed such questions to have on some students, suggests that further research is need as a matter of urgency.

In our own interviews of students concerning how they approached studying a Block of D101 material we encountered quite a number of references to the impact of in-text questions upon their study. Indeed, the most illuminating evidence to date has come from open-ended feedback questions where students have been given the opportunity to comment upon the effectiveness of questions from their own perspective.

Data from individual interviews are able to set student experience of particular in-text questions in the context of their approach to studying the text and their overall orientaton to study. The following is an example of a student who described her approach to the text as an attempt to remember as much as possible and here describes her use of in-text questions in what appears to be an instrumenal way, primarily concerned with meeting the demands of assessment

> "Well I think they (SAQs) are useful because as I say they pick out the more relevant points, and there is such a lot of work you couldn't possibly remember it all, so you've got to pick out the important points and that's a way of doing it....you don't really know if you areinterpreting the work in the way that is expected of you,but obviously, although it might be useful to have read it and to understand it in a way you think you have. ..... one obviously wants to pass the exam, so you have got to try to....work in the way that the course intends you to, and I think that is really what they are for."

Are in-text questions intended to have this effect of indicating that certain things are to be correctly remembered, while personal understanding of other aspects of the text are not valued? By questioning students about specific course content, and the role of in-text questions, a clearer picture may emerge.

The use of stimulated recall, to talk students back through their interaction with texts, rather than accepting what could be post hoc rationalisations is an obvious advantage. The extract below reveals how stimulated recall cannot only focus attention on specific aspects of a course but can evoke comments that may otherwise be lost.

S Yes, I find they are very helpful. I don't do them all because some of them I don't feel are relevant..... This one is SAQ 3 which is (about) Operational Defination, you see Operational Defination. I've underlined that. Operational Defination - you don't usually use that as an expression.

I So you underline that because it's new.

S Yes, anything that is new or surprises me very much.. ... why have I put that I wonder? "Generalisations should be judged in terms of their usefulness and reliability not their absolute truth" That seemed to me that it was saying that it didn't matter if it was a pack of lies. I didn't seem to understand that too well, so I just put a question mark by it

By means of interview, and stimulated recall, it is possible to explore students' experience of particular questions in depth and reveal further aspects to investigate. It is unlikey that close-ended questions would be as revealing.

The final example relates student experience to the rationale exployed by an author in his design of an in-text queston. The particular question was meant to stimulate and required an open-ended response.

S "Well the SAQ said something like: 'try jotting down some of the things that social scientists might be able to find out about you by studying you in connection with your work' I thought - 'oh no! I haven't got time to do that'. Even if I could have come to some conclusions about that, I wouldn't have bothered to write it out.

I Why not?

S Because I'm hurrying to get on to the next paragraph - get as much reading in as I can"

The student, who seemed to read much faster than most students, appeared to be adopting a surface level approach to her study and was reacting to the question in a way far from the expectations of the author who posed it.

We believe that a research study which uses interviews to explore student experience of particular questions in-depth, with the aid of stimulated recall, is likely to reveal important information about student perception and use of in-text questions. Such an investigation should set student experience in the context of their orientation to OU study in general and their approach to studying in particular. It could reveal the extent to which the rationale employed by authors are accepted by students and the extent to which the expectations of authors are justified by actual student use of the questions posed.

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